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The Hard Stuff! All About Bones

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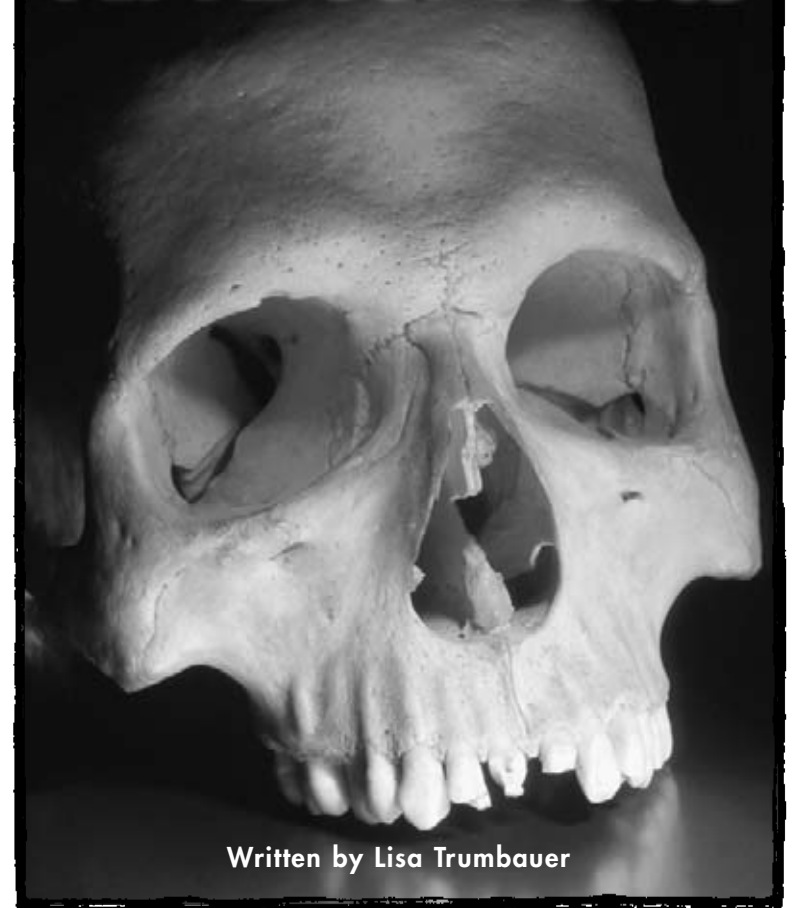



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The Hard Stuff! All About Bones



Written by Lisa Trumbauer

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Index

- arm, 14, 15
 - humerus, 14, 19
 - radius, 14
 - ulna, 14
- bone cells, 20, 21
- bone marrow, 20, 22
- brain, 6, 8, 11
- broken bones, 21
- cartilage, 9, 13
- clavicle (collarbone), 12, 13
- cranium (skull), 5-8, 10, 12, 19
 - occipital bone, 7
 - parietal bone, 7
 - supraorbital ridge, 7
 - temporal bones, 7
- ear, 8
 - anvil, 8
 - hammer, 8
 - stirrup, 8
- fingers, 14, 15
- foot, 17
- hand, 15
- jaw, 8
 - mandible, 8
 - maxilla, 8
 - zygomatic bone, 8
- joint, 7, 16, 18
 - ball-and-socket, 19
 - hinge, 19
 - suture, 7, 19
 - swivel, 19
- legs, 16
 - femur, 16-19
 - fibula, 16, 17
 - patella (knee), 16
 - tibia, 16, 17
- nerves, 11
- nose, 9
- pelvic bone (hip), 12, 13, 18, 19
- pelvis, 12, 13, 16
- red blood cells, 20, 22
- rib cage, 12
- scapula (shoulder), 12, 18
- spinal column (backbone), 10-12, 19
- vertebrae, 10, 19
 - atlas, 10
 - axis, 10
 - cervical, 10
 - coccyx, 10
 - lumbar, 10
 - sacral, 10
 - thoracic (dorsal), 10, 12
- wrist, 14, 15

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Correlation

LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	24
DRA	40

Glossary

appendages	arms and legs (p. 14)
ball-and-socket	joints that fit together like a ball fits into a glove (p. 19)
bone marrow	material in large bones that creates red blood cells (p. 20)
calcium phosphate	a mineral that helps keep bones strong (p. 22)
cartilage	a tough, rubbery substance found at the end of bones or in the nose (p. 9)
dexterous	able to make precise movements (p. 15)
hinge	joints that open like a door (p. 19)
ligaments	tissues that connect one bone to another bone (p. 5)
spinal cord	collection of nerves protected by vertebrae (p. 11)
sutures	joints or seams between skull bones (p. 7)
swivel	tilt or turn (p. 19)
tendons	tissue that attaches muscles to bones (p. 5)
vertebrates	animals with an interior skeleton (p. 4)

Explore More

On the Internet, use *www.google.com* to find out more about topics presented in this book. Use terms from the text, or try searching for glossary or index words.

Some searches to try: *skeletal system*, *bone marrow*, or *spinal column*.



Bones help
you do all
kinds of fun
activities.

Bones need to remain healthy in order for them to remain strong. Eating a well-balanced diet ensures not only that the bones will continue to be strong, but also that they will continue to produce healthy blood cells in the bone marrow. Foods rich in **calcium phosphate** are especially important. Dairy products like milk have calcium, which is why doctors often suggest that people drink milk. Exercise also keeps your bones in good working order.

Your bones give your body its shape, but they also give you much more. They give you the ability to move, to sit, to stand, and to write. You wouldn't be you without your bones!



— **Table of Contents** —

Body Shapers4

Heads Up6

Put Your Back Into It10

And Now the Appendages14

Don't Get Out of Joint18

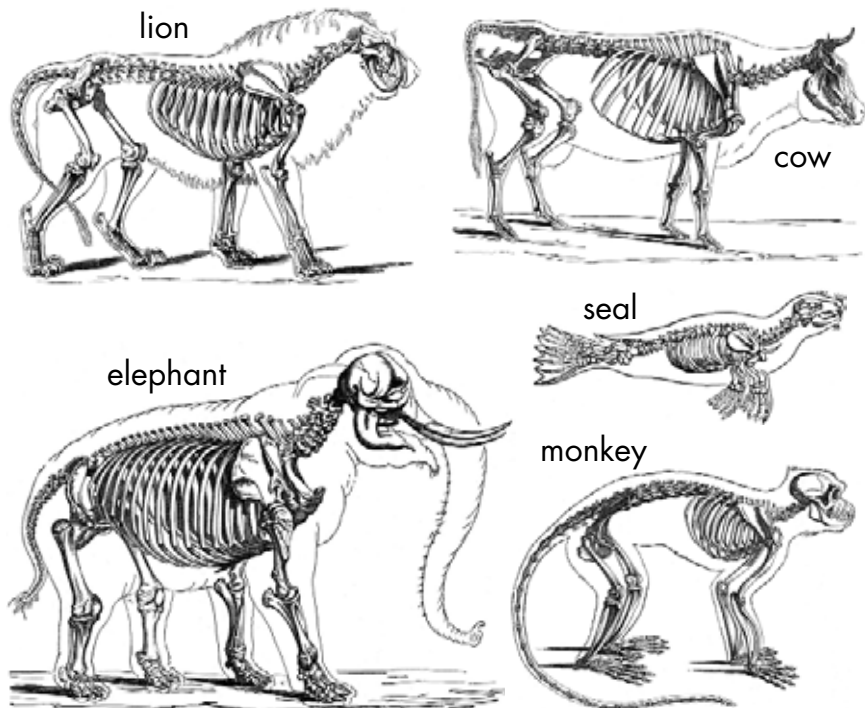
Inside Your Bones20

Keeping Bones Healthy21

Glossary23

Explore More23

Index24



— Body Shapers —

Lizards have one. Elephants have one. Even fish in the ocean have one. You have one, too! What do you all have? You all have skeletons.

A skeleton is a collection of bones that is found inside an animal's body. The skeleton is like a frame that has muscles, blood vessels, and skin wrapped around it. Skeletons give many animals, called **vertebrates**, and all humans their shape and form. In fact, you can identify many animals just by looking at their skeletons.

— Keeping Bones Healthy —

Even though bones are very strong, they can break if they are struck with enough force. Broken bones can be fixed with a little help from a doctor and a lot of help from bone cells.

In order for a bone to heal properly, the bone must be put back together exactly the way it was before the break. Depending on how severe the break is, doctors may need to move around the broken bones to put them back together.



A cast is then placed around the body part where the bone was broken. The cast prevents the body part from moving so the bone has time to heal. As soon as the bone broke, the bone cells immediately began repairing it. Holding the broken bone in place with a cast lets the bone cells do their job.

A cast helps hold broken bones in place so they can heal.

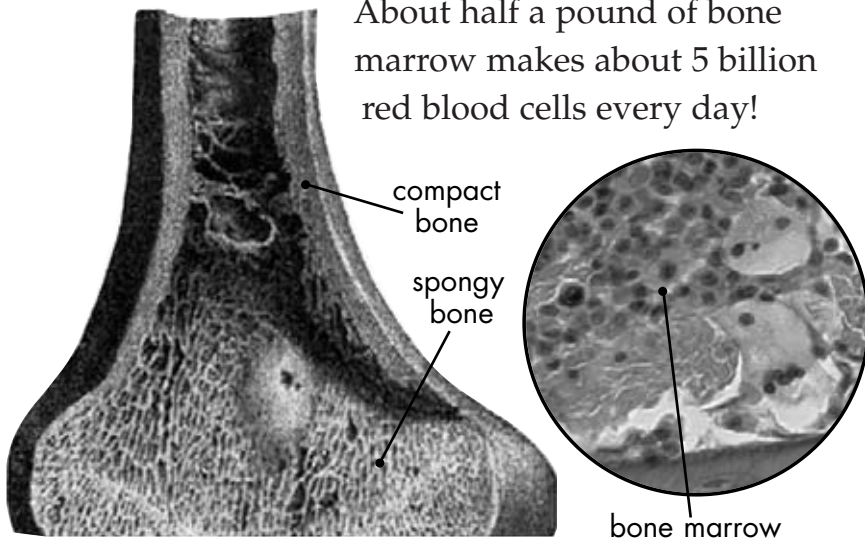
🦴 Inside Your Bones 🦴

It might seem as if a bone is nothing more than a hard, solid object, like a rock, but that couldn't be further from the truth. Bones are definitely alive with thousands of bone cells that need oxygen and food to survive, just like other types of cells.

On the outside, a bone is hard and solid. This outer layer is called the compact bone. Below the compact bone is the spongy bone, which has holes to keep the bones light in weight so our muscles can lift them.

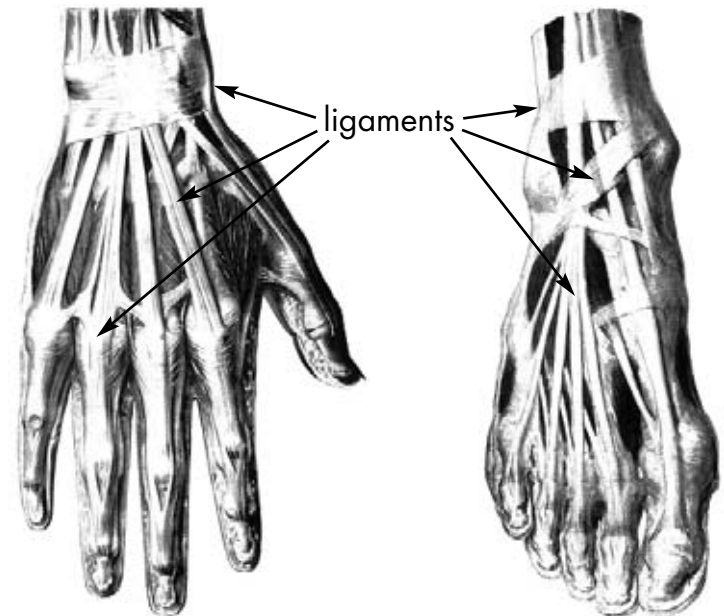
Below the spongy bone and also within it is the **bone marrow**. The bone marrow is important because it is where the body makes blood cells.

About half a pound of bone marrow makes about 5 billion red blood cells every day!



The human skeleton is made up of 206 bones, starting at the top with the skull and ending at the bottom with the toe bones. Many bones have muscles attached to them by **tendons**, and these bones help us to move. Some bones protect delicate organs inside our bodies—for example, the heart and the brain. And many large bones have a special core that produces blood cells. All the bones are connected to each other with special tissues called **ligaments**, which help make up the skeleton.

To fully appreciate the function of bones, let's take a closer look at specific body areas.



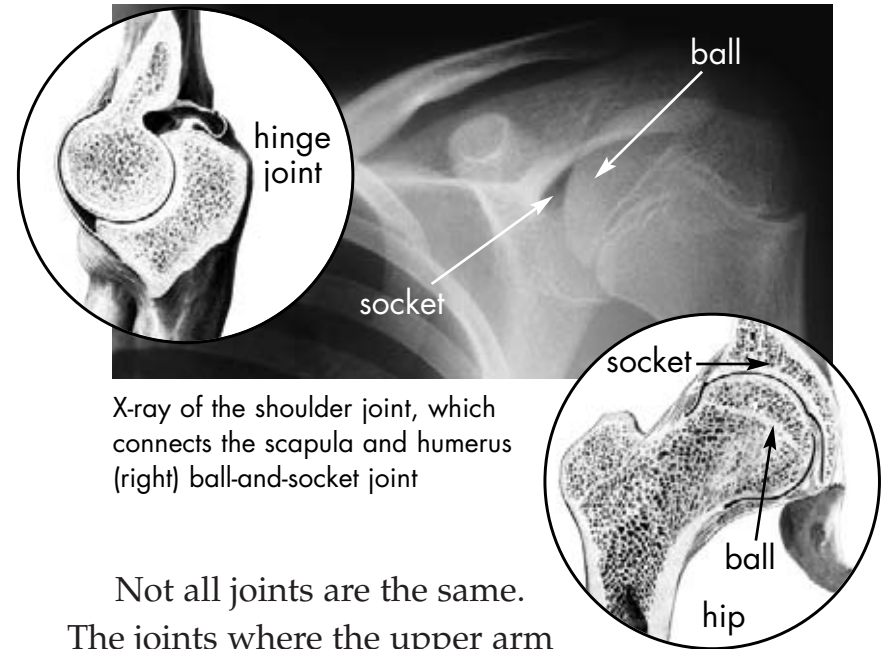
These ligaments hold the hand and foot bones together.



These racers wear helmets to protect their skulls.

— Heads Up —

Press your hand against your forehead—the part of your face above your eyebrows. Does your forehead feel soft, like a pillow, or does it feel hard, like a desk? Your forehead feels hard because you can feel your skull, or *cranium*, under the skin. The cranium is one set of bones in your body, and it protects your brain, which is very important and very delicate. In some ways, the cranium is like a crash helmet, except it is not as strong. That is why when you ride a bike, in-line skate, or participate in some other sports, wearing a helmet provides extra protection.



X-ray of the shoulder joint, which connects the scapula and humerus (right) ball-and-socket joint

Not all joints are the same. The joints where the upper arm bone is connected to the shoulder bone and where the upper leg bone is connected to the hipbone are **ball-and-socket** joints. The top ends of the humerus and the femur have a ball shape. These balls fit snugly into a round socket in the shoulder and hipbone respectively.

The knee joint and the elbow joint are examples of **hinge** joints. Here, the joints can only bend in one direction. The joints between the vertebrae of your spine are called **swivel** joints, which enable the body to tilt and turn. And the last type of joint is a suture joint, like those found on the skull. These joints connect bones but do not allow any movement.

— Don't Get Out of Joint —

Along with over 206 bones, the human body has over 100 joints. Joints are the places where bones meet. Bones are hard and unbending, but because bones are connected at joints, our bodies can bend and twist.

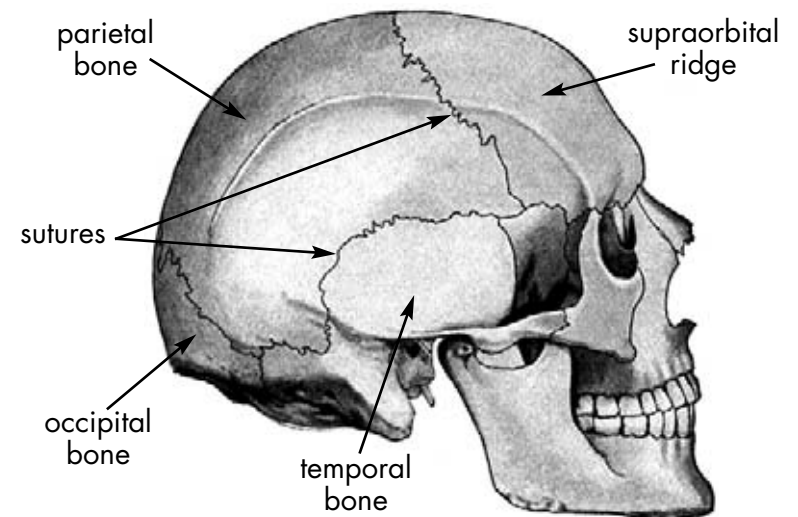


Bones Bonus

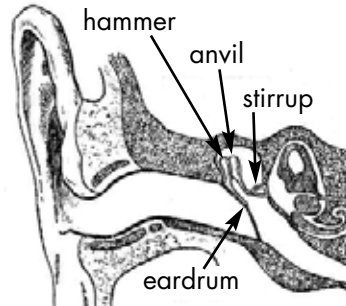
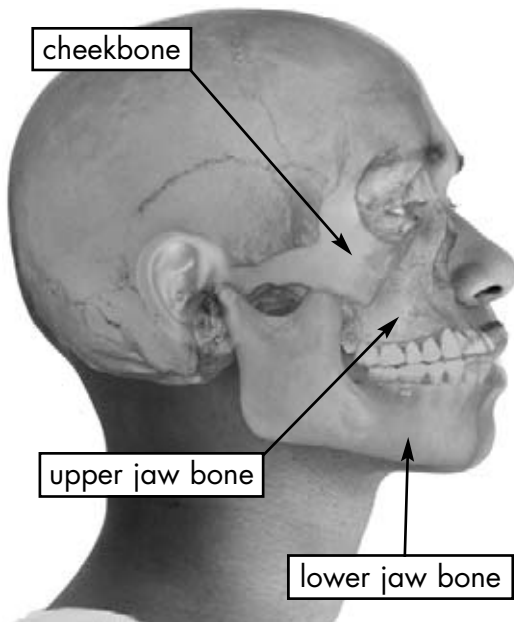
Sometimes we say that people are double-jointed, but this doesn't mean that they have two joints instead of one. Double-jointed people are more flexible than the average person because the ligaments between the joints are looser. These loose ligaments enable them to bend in unusual ways.

If you feel around your head, your skull appears to be all in one piece. Actually, though, the skull is made up of several different bones. The bones are held together at special joints called **sutures**. Unlike regular joints, which allow movement, the suture joints are immovable.

Remember touching your forehead? This part of the skull is the frontal bone. A more technical term for your forehead is the *supraorbital ridge*. The largest part of your skull covers the top and back of your head. This bone is called the *parietal* (pa-RI-a-tul) *bone*. The part of your skull just above your neck in the back is the *occipital* (awk-SIP-i-tul) *bone*, and the sides of the skull, above the ears, are the *temporal bones*.



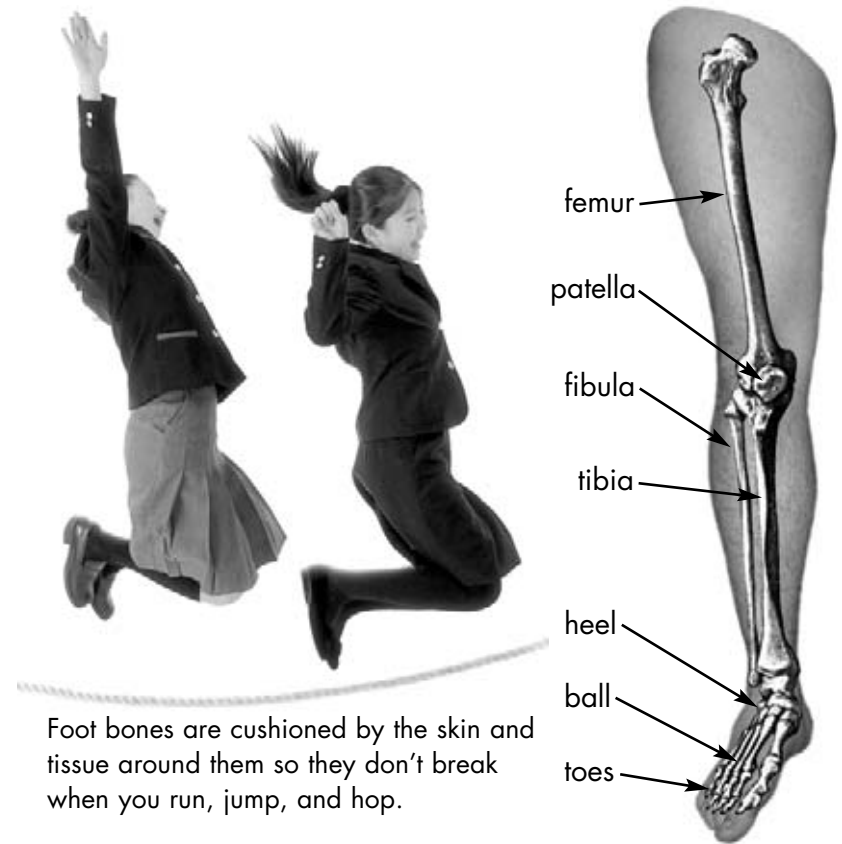
In all, your skull has 29 bones. The rest of the bones in your skull are the bones in your face, in your ears, and in your jaw. Beneath the skin on your cheek, you can probably feel your cheekbone, or the *zygomatic bone*. Your jaw is made up of two bones—the upper jaw, or *maxilla*, and the lower jaw, or *mandible*. The lower jaw is one of the only bones in your skull that can move on its own.



Bones Bonus

Your ears also have bones—the hammer, the anvil, and the stirrup, which are attached to the eardrum. These bones are not only the tiniest bones in your body, but they also are the other skull bones that can move.

When the eardrum picks up sounds and vibrates, the eardrum moves the hammer. The hammer then vibrates, which makes the anvil vibrate, which in turn pushes the stirrup bone! The brain receives the vibrations and interprets them as words, music, or other sounds.



Foot bones are cushioned by the skin and tissue around them so they don't break when you run, jump, and hop.

Like a hand, the foot is a complex system of many bones. Each foot has only one less bone than a hand—26—for a total of 52 bones for both feet. The heel of a foot has seven *tarsal* bones, and the ball of a foot has five *metatarsal* bones. Like the hand, the foot has 14 *phalange* bones—two for the big toe and three each for the remaining toes. Skin and tissue on the bottoms, or soles, of the feet protect the bones from the impact of jumping and running.

The structure of the legs and feet is comparable to the structure of the arms and hands. The top portion of the leg is one solid bone, called the thighbone, or *femur*. The bottom part of the leg comes in two parts—the shinbone, or *tibia*, and the *fibula*. Between the upper and lower parts of the leg is one more bone—the kneecap, or *patella*. The kneecap lies over the knee joint and protects the tendons beneath that allow the leg to bend.

Bones Bonus

The longest, strongest, and largest bone in your body is in your leg. It's the thighbone, or femur. It extends from the pelvis to the knee. To break the femur requires a lot of force. For example, you would have to fall from a great height or have a high-speed collision while skiing or skating.



Leg bones help us move in many ways.



Teeth are harder than bones.

Cartilage is softer than bones.

If you look at a skeleton, you might see something missing from the skeleton's face—a nose. Your nose is not made out of bone, but out of a tissue called **cartilage** (CAR-ti-lidg). Cartilage is more flexible than bone. Try it—touch your nose and move it around. It can bend, whereas your bones cannot. Cartilage is also found at the ends of bones to keep one hard bone from rubbing against another hard bone.

Skeletons also have teeth, but teeth are not bones. In fact, teeth are harder than bones. The outside of a tooth is made of a substance called enamel. It is the hardest substance in the body.

Put Your Back Into It

The skull connects to a major system of bones—the spinal column, also called the backbone. You can feel the first few parts of the spinal column at the back of your neck. These ridges continue down your back, all the way to your hips. These ridges are the individual bones of your backbone, and they are called *vertebrae* (VER-te-bray).

The backbone has 33 vertebrae in all. Seven vertebrae are found in the neck, and they are called the *cervical* vertebrae. Twelve vertebrae run from the top of your back to about the middle of your back, and they are called the *thoracic* (the-RA-sik) or *dorsal* vertebrae. Five *lumbar* vertebrae are found at the small of your back, followed by five *sacral* vertebrae, which sit between your hips. The remaining vertebrae form the *coccyx* (KOK-sicks) bone at the bottom of your spinal column.



Bones Bonus

The top two vertebrae are called the *atlas* and the *axis*. These two vertebrae allow you to nod and shake your head.

Many for Manipulating

Your fingers may be smaller than your arms, but they have more bones. Here's how the numbers of bones in each part of your hands and arms compare.

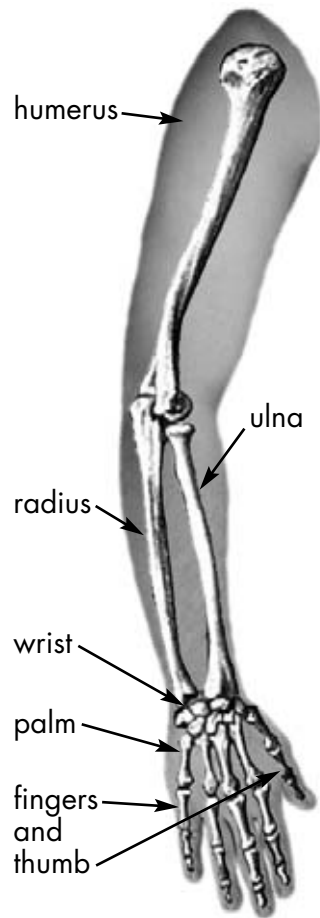
Arm: 3	Each thumb: 2
Wrist (<i>carpus</i>): 8	Fingers and thumbs
Palm (<i>metacarpus</i>): 5	(<i>phalanges</i>): 14
Each finger: 3	



Your hand, including your wrist, is full of bones. In fact, your hand and wrist together have more bones than any other part of your body—27! That's 54 bones total for both hands. Because hands and wrists have so many bones, they are very flexible and **dexterous**, and we can do small, precise activities, such as writing and drawing, playing the piano, and tying shoelaces.

— And Now the Appendages —

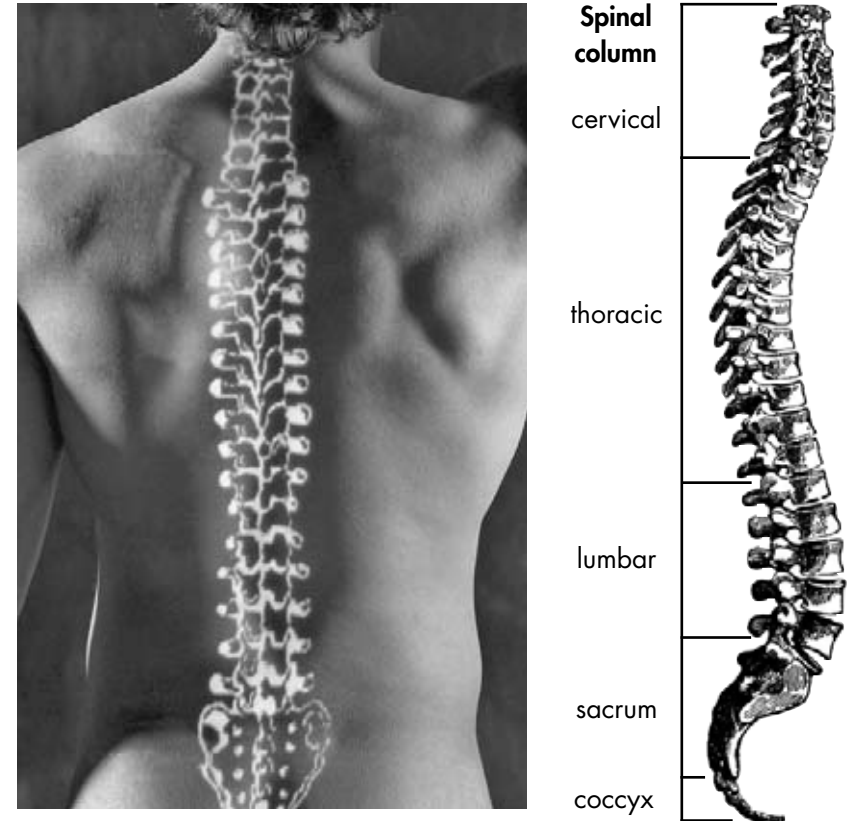
Your hands and arms, feet and legs, are your **appendages**, and they enable you to do many different activities. Your hands and arms enable you to lift and hold things, while your feet and legs help you to move. Being able to do these actions is partially possible because of the bones inside your appendages.



Your arms are made up of three bones each—the *humerus*, the *ulna*, and the *radius*. The humerus is the upper arm bone, and it is attached at the top to the shoulder. The ulna and the radius make up the lower part of the arm, between the wrist and the elbow.



These kids use their arms to help hold themselves up.

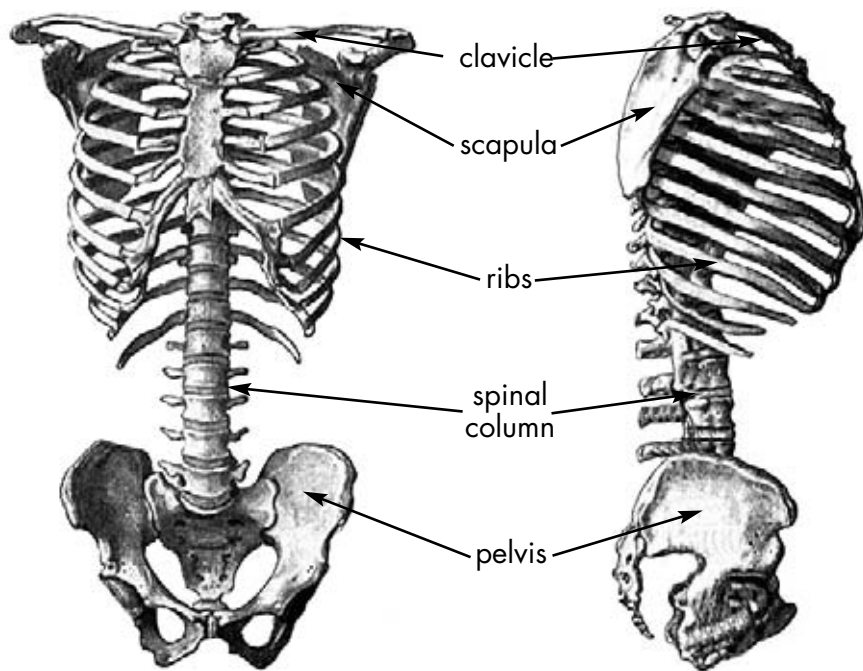


Your spinal column has two very important functions. First, the spinal column protects the delicate **spinal cord**, which runs through the vertebrae. The spinal cord is the place where all the nerves in your body meet to transmit information to your brain.

The second function is that the spinal column allows you to bend and twist, roll and flip. Because the backbone is a chain of bones, not one solid bone, it is very flexible.

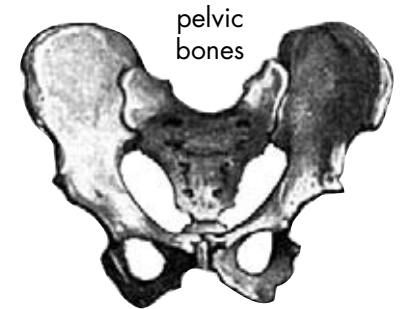
The skull is not the only bone attached to the backbone; the shoulder bones, ribs, and pelvic bones are attached to it, too.

Along with giving shape to your torso, the ribs serve a very important purpose—to protect the lungs and heart. The lungs and heart lie inside the ribs, which form the rib cage. So if you bang your torso, your lungs and heart don't get squashed because the ribs provide a sturdy wall around them. Your rib cage has 12 bones on each side, and each of those bones is connected to one of the 12 dorsal vertebrae.



At the top end of the spinal column, you will also find the *scapula* and the *clavicle*. Scapula is the technical term for the shoulder blade, and clavicle is the technical term for the collarbone. The scapula and the clavicle make up the shoulder.

Near the bottom of the backbone is the hip bone, or *pelvic bone*. On each side, the pelvic bone looks like a shallow dish or bowl. That's because in this area of the body lie your intestines and other lower-body organs.



Boning Up

The skeleton of a newborn baby is not the same as an adult's skeleton. An unborn baby has cartilage instead of bones. As the unborn baby grows and develops, the cartilage hardens and turns to bone. By the time the baby is born, most of the cartilage has hardened and turned to bone.

As babies become children and children become adults, their bones continue to harden or even join together. One of the last sets of bones to join together is the group that makes up the pelvis. These bones become one solid structure when a person is in his or her late teens or early 20s.

